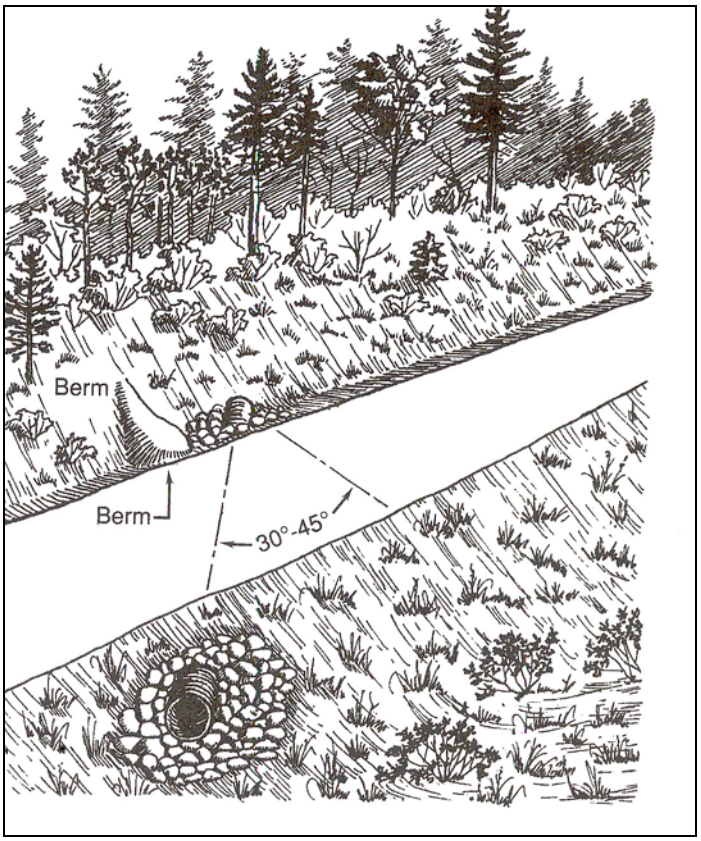

Figure 11. Cross-Drainage Culvert.
(Re-printed courtesy of Wisconsin DNR)

8. STREAM CROSSINGS

As described in “Section 2 Laws and Permits”, installing a new or upgrading an existing stream crossing requires a permit from DEQ prior to installation. This is through the DEQ/US Army Corps of Engineers (USACE) joint permit application process.

It is best to work with local DEQ staff when developing plans for stream crossings from the outset. This will result in less time and effort for the landowner or their designated agent during the permit application and review process. Information regarding this application is available at www.michigan.gov/jointpermit. Permit requirements apply to intermittent streams (flows only occur during certain times of the year, particularly spring during snowmelt), as well as permanently flowing streams. A stream, permanent or intermittent, is an area with a defined streambed and bank and visible evidence of a continued flow or continued occurrence of water. While dry for much of the year, intermittent streams are important during frequent rains in the spring. Because of these frequent rain events, intermittent streams provide essential habitat for trout and other fish during spawning runs. Therefore, protect them as carefully as you would a permanent flowing stream.

It is against DEQ regulations to transport felled logs or heavy machinery through even the smallest, shallowest dry streambed. Instead, there are two placement techniques for stream

crossings that work best, depending on the circumstances -- a pipe culvert installation, or a portable bridge.

Portable Bridges

Portable bridges, often referred to as temporary bridges, are the preferred method when a stream crossing is required to skid or transport timber products and the stream crossing will be temporary in nature (defined by DEQ as a permitted crossing in place less than 2 years). These bridges can be constructed out of laminated, pressure treated wood (see Figure 12) or can be prefabricated folding metal structures (see Figure 13).

These bridges are generally designed to support skidders and forwarders, but may also be constructed sturdy enough to support tandem axle haul trucks as they transport wood products from the landing to the mill.

Studies conducted by the Forest Service and University of Auburn on the Talledega National Forest showed that installing a portable bridge resulted in 98% less sediment entering the stream compared to installing a culvert.

The key advantages over culverts are:

- Minimize stream siltation.
- Meet or exceed most BMP guidelines.
- Keep wood and other debris out of waterways.
- Reusable.
- Minimize erosion.
- Keep streams clear of debris after installation
- Provide unimpeded fish passage
- No impacts on the stream bottom

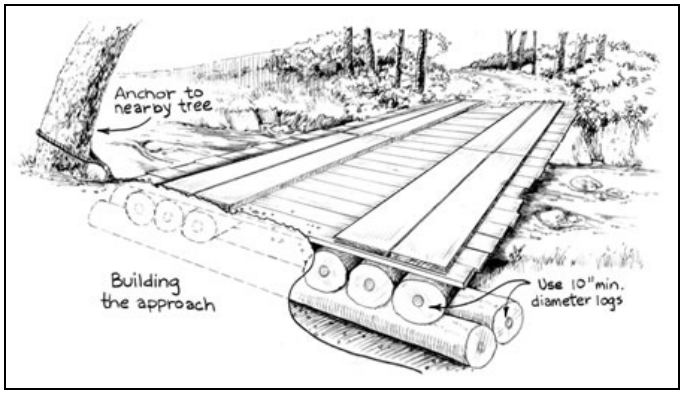

Figure 12. Example of a Wooden Portable Bridge.

(Re-printed courtesy of the University of Minnesota Extension Service.)

Figure 13. Example of a Portable Folding Metal Bridge.

Crossing Streams Using Culverts

Culverts are another option for crossing streams. However, use of culverts instead of portable bridges increases the amount of sediment deposition during installation and removal, as well as increasing the likelihood of impeding fish passage. They are made from corrugated metal pipe or other suitable material (e.g. hard plastic) and placed under a haul road or major skid road to transmit flows from permanent streams and small intermittent streams. Culvert installation and placement requires that the persons responsible for installation and removal take extra care and attention to reduce sediment deposition to the stream as much as possible. It is important to work with local DEQ staff on how to meet permit requirements and install a culvert to minimize sedimentation during installation and removal.

Culvert Installation and Placement

When installation of a portable bridge is not an option, the culvert can be installed using the following BMP specifications:

- Install culverts so that there is no change in the stream bottom elevation. This will allow for unimpeded fish migration (see Figure 14).
- Place barriers or rock from the upstream culvert end to the stream banks to direct flow into the culvert.
- Place barriers or rock at the downstream culvert end to the stream banks.
- Firmly compact fill materials around culverts, particularly around the bottom half. Fill material should be a minimum of 1 foot over the pipe, or at a depth specified by the culvert manufacturer (see Figure 15).
- Use riprap around the inlet and outlet of the culvert, as well as geotextile underneath the riprap to prevent stream flows from eroding and undercutting the culvert (see Figure 16).

- Pipe length should be long enough so both ends extend 2 feet beyond side slope (cross drainage culverts require only 1 foot beyond side slope).
- The pipe diameter is matched to expected high water flows.

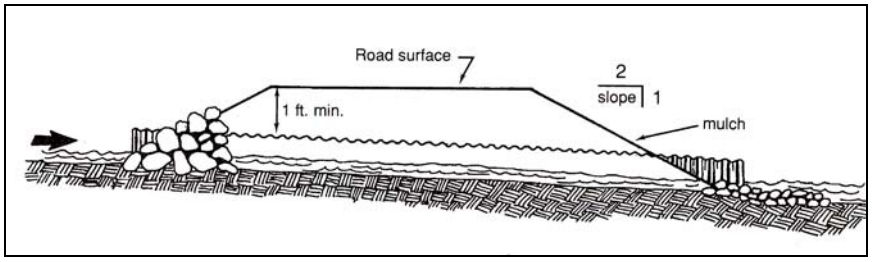

Figure 14. Culvert Installation Without Change in Stream Bottom Elevation.

(Reprinted courtesy of the Wisconsin Department of Natural Resources)

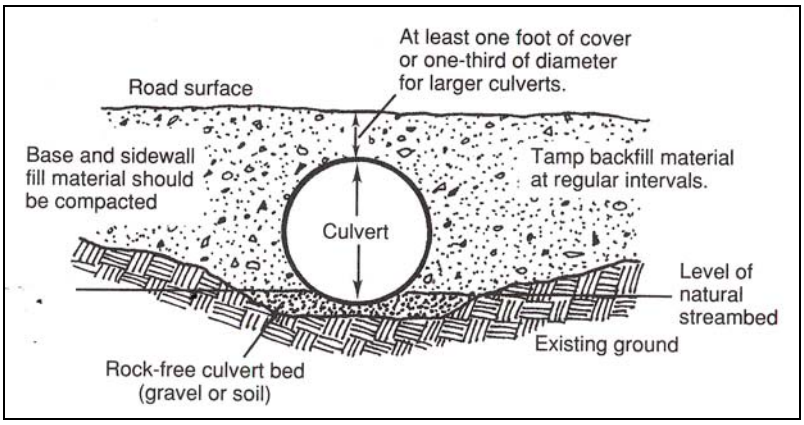

Figure 15. Illustrations and Instructions for Installation of a Stream Crossing Culvert.

(Reprinted courtesy of the Wisconsin Department of Natural Resources)

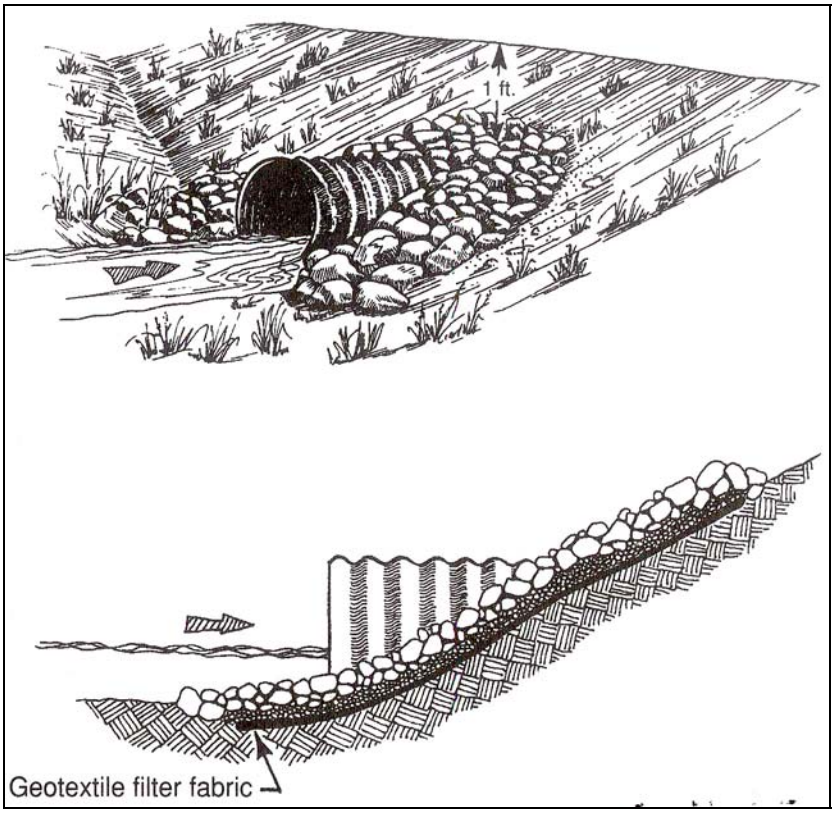

Figure 16. Illustration of Proper Use of Riprap & Geotextile Around Inlet of Stream Crossing Culverts.

(Re-printed courtesy of the Wisconsin Department of Natural Resources)

The MESBOA Method for Installing Stream Crossing Culverts

The MESBOA method, first developed in Minnesota, as a joint effort between the Forest Service and Minnesota Department of Natural Resources to develop a method that properly sizes, orients and installs culverts based primarily on the stream's physical characteristics. The "MESBOA" is an acronym comprised of the first letter of each of the six steps. The DEQ considers this method as the best approach to ensure unimpeded fish passage, minimizing the risk of a culvert being washed out during a significant storm event.

- **The Six Steps in the Sizing and Placement of Culverts**

The following are general instructions to apply when using the MESBOA method to determine the appropriate size, length, width and number of culverts needed for a giving stream crossing:

1. **M**atch culvert width to bankfull stream width (see Figure 17).
2. **E**xtend culvert length through the side slope toe of the road.
3. **S**et culvert slope the same as stream slope (failure to set culverts on the same slope as the stream is the primary reason that many culverts impede fish passage).
4. **B**ury the culvert 4 to 12 inches into the stream bottom. For culverts 2 to 6 feet in diameter, dig 10 to 18 inches below the stream bottom.
5. **O**ffset multiple culverts.
6. **A**lign the culvert with the stream channel.

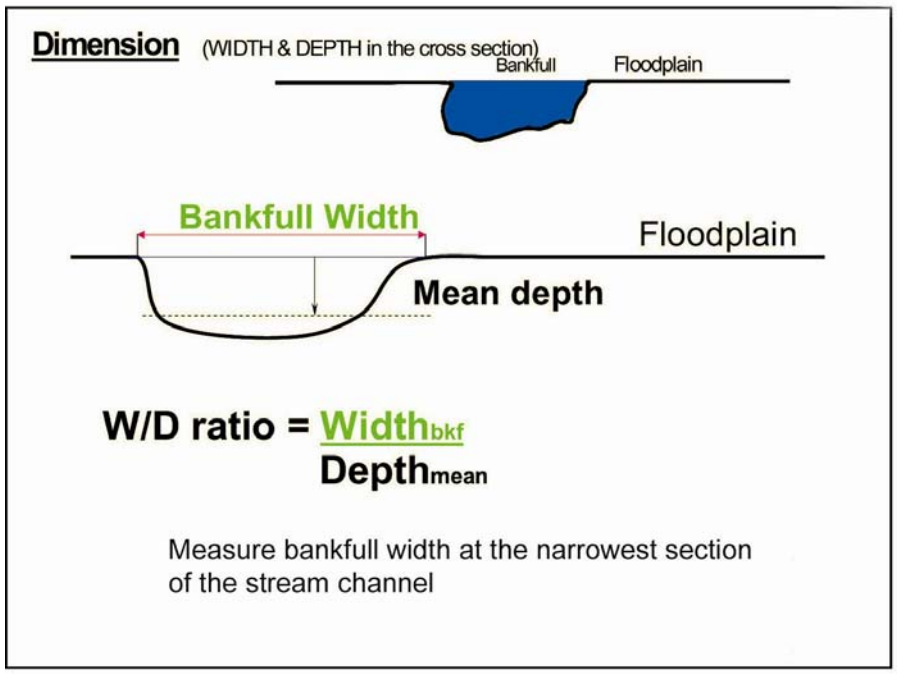

Figure 17. Measuring Bankfull Width.

- **Guidelines Regarding The Application of The Mesboa Method Based on Stream Channel Width And Culvert Diameter**

The following are guidelines to aid forest managers or loggers as what measurements are needed based on bankfull width of the channel being crossed, stream depth, and the slope of the stream bottom. As the size of both the culvert and channel width increase, so too does the likelihood of having to obtain the services of a professional surveyor and civil engineer to insure the culvert is properly sized and installed.

The following is guidance of what efforts or resources may be required based on culvert diameter and channel width using the MESBOA approach:

- Culverts are 2 to 3 feet in diameter and channel is 2 to 6 feet wide.
  - Need only bankfull width and reasonable estimate of stream bottom slope and burying depth.
- Culverts are 3 to 6 feet in diameter and channel is up to 12 feet in width.
  - Need bankfull width, and accurate longitudinal profile of the stream to have exact slope of the stream and culvert elevation at both the inlet and outlet. Will require the use of level survey equipment.
- Culverts are greater than 6 feet in diameter or wide arch design and channel is greater than 12 feet in width.
  - Need bankfull width, longitudinal profile, 1-3 cross sections and use computerized culvert design programs to confirm that all measurements accurately dictate culvert design and installation parameters. Generally applied when stream crossing design requires the involvement of a registered professional civil engineer.